

and the semiconductor film of the first thin film transistors is not intentionally added with germanium, as recited in independent Claim 30. Instead, the Examiner argues that:

“...the specification discloses that the semiconductor films of claim 30's [and the claims dependent thereon] first and second thin film transistors consist of silicon (Si) and silicon germanium (SiGe), respectively. See the specification at page 8, lines 13-21, for example.”

Applicants respectfully traverse this rejection.

As disclosed in the specification (see e.g. page 5, lns. 14-27 and Fig. 1) in an embodiment of the present invention, a display device of an active matrix type comprises a pixel matrix circuit 101 and a gate driver circuit 102 (and other elements). The pixel matrix circuit 101 is formed of a polysilicon film. The driver circuit has a TFT group active layer using a polycrystalline silicon germanium film. The polysilicon germanium film is formed by selectively adding germanium. Id. Before the germanium is added, a resist mask is formed over those regions, such as the pixel matrix circuit, where it is not intended that germanium should be added. The germanium is then added to regions such as the driver circuit. See page 6, lns. 16-25. Hence, the concentration of germanium in the “semiconductor film of said second film transistor” of the driver circuit will contain germanium, and the concentration of that germanium will be higher than the concentration of any germanium that may have unintentionally been added to the “semiconductor film of the first thin film transistor.”

Applicants have amended the form of the language in independent Claim 30 to make this clear. As explained above, the specification clearly supports the language of this claim. For substantially the same reasons, the similar limitations in the other rejected claims are also supported by the specification. Therefore, it is respectfully requested that this rejection be withdrawn.

The Examiner also rejects Claims 30-38 and 41-43 under 35 USC §112, first paragraph, as non-enabling for the same reason discussed above. For the reasons explained above, the

specification clearly supports the limitations in these claims, and, therefore, the specification is enabling for those claims. Accordingly, it is also respectfully requested that this rejection be withdrawn.

§112, Second Paragraph Rejections

The Examiner further rejects Claims 1, 4, 7, 10, 13, 31, 34, 37 and 39 under 35 USC §112, second paragraph, as being indefinite. In particular, the Examiner objects to the language in Claim 1 of "a second thin film transistor having a second active layer comprising silicon...wherein said active layer is not intentionally added with germanium." The Examiner argues that the "specification discloses that the second thin film transistor's active layer is silicon (si)." As explained above, the specification clearly explains that the "second active layer" of the "second film transistor" of the device of Claim 1 comprises silicon, and that by placing a resist over the layer when germanium is being added to the driver circuit ("first active layer" of Claim 1) and other layers, germanium is not being intentionally added to the "second active layer". Hence, Applicants submit that in light of the specification, this language is not indefinite. For substantially the same reasons, the other rejected claims are also not indefinite. Therefore, it is requested that the rejection thereof be withdrawn.

§103 Rejections

The Examiner further has the following rejections under 35 USC §103:

- (a) Claims 2, 5, 11, 14 and 40 as being unpatentable over Zhang et al. '733 together with King et al.;
- (b) Claim 8 as being unpatentable over Zhang et al. '733 together with King et al. and Zhang et al. '277;

- (c) Claims 1, 4, 10, 13, 30-35, 39, 41 and 42 as being unpatentable over Zhang et al. '733 together with King et al.;
- (d) Claims 7, 36-38 and 43 as being unpatentable over Zhang et al. together with King et al. and Zhang et al. '277.

Each of these rejections is respectfully traversed.

The present invention is directed to a semiconductor device such as an active matrix display device having at least two thin film transistors. In accordance with a typical example of the present invention, a pixel TFT connected to a pixel electrode has a channel region comprising silicon which is not doped with germanium (i.e. germanium is not intentionally added to this layer, this can be accomplished by using a resist mask; see *supra* and pages 5-6 of the specification) while a TFT included in a driver circuit for driving the pixel TFT has a channel region comprising silicon which is doped with (i.e. added) germanium (see *supra* and pages 5-6 of the specification). The TFT having a channel region comprising silicon doped with germanium is suitable for realizing a high field effect mobility.

However, Applicants recognized a problem in that such a TFT tends to have a higher off current due to the large carrier density. Based on the recognition of this problem, Applicants' invention resides in the use of the TFT having a channel region comprising silicon doped with germanium in a selected portion of the semiconductor device depending upon the required characteristics of the circuits.

For example, as explained above, the germanium is selectively added to the semiconductor film of the driver circuit (the circuit section requiring high speed characteristics) but is not intentionally added to the semiconductor film of the pixel matrix circuit (the circuit section requiring low off current characteristics) as a mask is used to cover this region when the germanium is being added. See pages 5-6 of the specification.

The Examiner, however, continues to assert as the primary basis of his rejection that:

“the difference between Zhang et al. (see the entire patent) and the set of rejected claims is their complementary driver circuit transistors are formed in polycrystalline silicon and polycrystalline silicon germanium, respectively”

and that:

“King et al. teach that it is advantageous to form complementary driver circuit transistors in polycrystalline silicon-germanium rather than polycrystalline silicon.”

The Examiner then concludes that:

“[i]t would have been obvious to one skilled in this art to advantageously form Zhang et al's complementary driver circuit transistors (but not its pixel circuit transistors, which Zhang et al. disclose are on a different design footing than the driver circuit transistors), in polycrystalline silicon-germanium rather than polycrystalline silicon, as taught by King et al.”

The Examiner then states that Applicants' prior response was not persuasive because it allegedly purports to characterize the references but simply glosses over them and oversimplifies or mischaracterizes the rejections and has not substantively addressed or rebutted the rejections.

However, under 35 U.S.C. §103, the burden is on the PTO to produce evidence that the claimed invention is prima facie obvious. In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993); In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). If the PTO fails to make out a prima facie case of obviousness, then the rejection is improper, should be overturned, and Applicants are entitled to a patent. Rijckaert, 9 F.3d at 1532, 28 USPQ2d at 1956; In re Nielson, 816 F.2d 1567, 1572, 2 USPQ2d 1525, 1528 (Fed. Cir. 1984); In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984).

It is respectfully submitted that the Examiner has failed to state a proper prima facie case of obviousness. In particular, the Examiner's combination of references to arrive at the claimed invention is improper under the standard set by the Court of Appeals for the Federal Circuit.

As the Federal Circuit has held on numerous occasions, "[w]hen a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references." Ecolochem, Inc. v. Southern California Edison Company, 56 USPQ2d 1065, 1073 (Fed. Cir. 2000). "Combining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability-the essence of hindsight." Id. Such hindsight reconstruction is improper, and a rejection based thereon should be withdrawn. Id. at 1072-1076.

In the present case, no such teaching, suggestion, or motivation has been provided in the rejection. Instead, the rejection merely concludes that it would have been obvious to combine these references, but there is no showing where there would have been motivation to do so.

In fact, Applicants believe that there is no such motivation to combine. As explained previously, Zhang '733 teaches to selectively add nickel, iron, cobalt or platinum (see col. 2, lns. 43-45 of Zhang '733) for promoting crystallization in a driver circuit TFT, while such a metal is not intentionally used in a pixel TFT. Zhang '733 does not teach that germanium can be used as the catalyst. King merely teaches to form a Si-Ge film and crystallize it.¹ Hence, there is no suggestion or motivation to combine these references in the manner suggested by the Examiner.

Therefore, Applicants can only conclude that Applicants' claimed invention is the blueprint for such combination. As this is improper hindsight reconstruction, it is respectfully requested that the rejections based thereon be withdrawn, and the claims allowed.

¹ Applicants respectfully submit that Zhang '277 does nothing to overcome the deficiencies of Zhang '733 and King.

Additionally, the Examiner's proposed combination of Zhang and King fails to disclose or suggest the invention recited in dependent claims 39, 40, 41, 42 and 43 as these claims recite that the semiconductor film contains both germanium and a metal selected from the group consisting of nickel, iron, cobalt and platinum and that is not disclosed or suggested by either references. Therefore, it is requested that those claims be allowed.

For at least the above-stated reasons, the claims of the present application are patentable over the cited references and in an allowable form. Accordingly, it is requested that they now be allowed.

Applicants have also added new dependent claims 44-48. Please charge our deposit account 50/1039 for any fee for these claims.

Favorable reconsideration is earnestly solicited.

Respectfully submitted,



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Date: June 3, 2002

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Marked-up copy of claims as amended:

30 (Amended). A semiconductor device having an active matrix type display device, said display device comprising:

- a substrate having an insulating surface;
- a plurality of pixel electrodes arranged in a matrix formed over said substrate;
- a plurality of first thin film transistors for switching said pixel electrodes and formed over said substrate;

- a driver circuit formed over said substrate for driving said plurality of first thin film transistors, said driver circuit comprising at least one second thin film transistor;

- each of said first thin film transistors and said second thin film transistor comprising:

- a semiconductor film comprising silicon and including at least one channel region;

- a gate insulating film adjacent to said channel region; and

- a gate electrode adjacent to said gate insulating film,

- wherein the semiconductor film of said second thin film transistor contains germanium [at a higher concentration than the semiconductor film of said first thin film transistors] and the semiconductor film of the first thin film transistors is not intentionally added with germanium and a concentration of germanium in the semiconductor film of the second thin film transistor is higher than a concentration of germanium in the semiconductor film of the first thin film transistor.

Please add the following new claims:

44 (New). The semiconductor device according to claim 1 wherein each of the first active layer and the second active layer further comprises a metal selected from the group consisting of nickel, iron, cobalt and platinum.

45 (New). The semiconductor device according to claim 2 wherein each of the first active layer and the second active layer further comprises a metal selected from the group consisting of nickel, iron, cobalt and platinum.

46 (New). The semiconductor device according to claim 30 wherein each of the semiconductor films of the first and second thin film transistors further comprises a metal selected from the group consisting of nickel, iron, cobalt and platinum.

47 (New). The semiconductor device according to claim 30 wherein each of the first and second semiconductor films further comprises a metal selected from the group consisting of nickel, iron, cobalt and platinum.

48 (New). The semiconductor device according to claim 36 wherein each of the first and second semiconductor films further comprises a metal selected from the group consisting of nickel, iron, cobalt and platinum.